Mocobi or Mbocobi tribe is not mentioned, but considered as forming, with the Toba and Abiponian dialect, a linguistic family separate from the Guaicuru. In this particular he has copied Balbi; but Balbi is formally contradicted by the Brazilian traveler Martius (*Beiträge* I, pp. 232, 780), who gives the missionary Dobritzhofer as his authority. The Texan tribe of the Tonkaways is relegated into Florida, and the Piqua regarded as an extinct Algonkin tribe, while it continues to flourish at the present time as a clan of the Shawnees or Shawanoes.

For advancing our knowledge of American ethnology and linguistic topography, not much is to be gained by copying and extracting modern and ancient authors who have not personally seen the tribes of which they give accounts. The number of false and inaccurate statements in this respect is simply enormous, especially regarding Central and South America. Reliable information on all these subjects can only be expected from future expeditions, made by conscientious travelers into the imperfectly explored regions of both American continents.—*Alb. S. Gatschet.*

GEOLOGY AND PALÆONTOLOGY.

DISCOVERY OF THE PREGLACIAL OUTLET OF THE BASIN OF LAKE ERIE INTO THAT OF LAKE ONTARIO.[1]—This is the subject of a lengthy paper recently read before the American Philosophical Society, of which Dr. Spencer gives the following summary:

1. The Niagara escarpment after skirting the southern shores of Lake Ontario, bends at nearly right angles in the neighborhood of Hamilton, at the western end of the lake; thence the trend is northward to Lake Huron. At the extreme western end of the lake this escarpment (at a height of about 500 feet) encloses a valley gradually narrowing to four miles, at the meredian of the western part of the city of Hamilton, where it suddenly closes to a width of a little more than two miles to form the western end of the Dundas valley (proper). This valley has its two sides nearly parallel and is bounded by vertical escarpments which are capped with a great thickness of Niagara limestone, but having the lower beds of the slopes composed of Medina shales. On its northern side the escarpment extends for six miles to Copetown, but westward of this village it is covered with drift, but it is not absent. On its southern side the steep slopes extend for less than four miles to Ancaster, where they abruptly end in a great deposit of drift, which there fills the valley to near its summit, but which is partly re-excavated by modern streams forming gorges from two to three hundred feet deep. To the north-eastward of Ancaster these gorges are cut down through drift to nearly the present lake-level. Westward of Ancaster, a basin occupying a hundred

[1] *Discovery of the Preglacial Outlet of the Basin of Lake Erie into that of Lake Ontario.* With Notes on the Origin of our Lower Great Lakes. By J. W. SPENCER, B.A.Sc., Ph.D., F.G.S., King's College, Windsor, N. S.

square miles, where the drift is found to a great depth, forms the western extension of the Dundas valley. With the north-western and western portions of this drift-filled area, the upper portions of the Grand river and Neith's creek were formerly connected. The Grand river from Brantford to Seneca runs near the southern boundary of this basin, then it enters the old valley which extends from Seneca to Cayuga, with a breadth of two miles, and a depth in modern times of seventy-five feet, having its bed but a few feet above Lake Erie. However, along the eastern margin of this valley, near Cayuga, we find that the rock is absent even to a depth below the surface of Lake Erie.

2. The Dundas valley and the country westward forms a portion of a great *river valley*, filled with drift. Along and near its present southern margin this drift has been penetrated to 227 feet below the surface of Lake Ontario, thus producing a *cañon* with a lateral depth of 743 feet, but with a computed depth in the middle of its course of about 1000 feet.

3. The Grand river, at four miles south of Galt, has, since the Ice age, left its ancient bed, which formerly connected with the Dundas valley, as did also Neith's creek, at Paris.

4. Lake Erie emptied by a buried channel, a few miles westward of the present mouth of the Grand river, and flowed for half a dozen miles near Cayuga, where it entered the present valley, and continued in its channel (reversed) to a place at a short distance westward of Seneca, whence it turned into the basin referred to above, receiving the upper waters of the Grand river and Neith's creek as tributaries, and then emptied into Lake Ontario by the Dundas valley. This channel was also deep enough to drain Lake Huron.

5. Throughout nearly the whole length of Lake Ontario, and at no great distance from its southern shore, there is a submerged escarpment (of the Hudson river formation), which in magnitude is comparable with the Niagara escarpment itself, now skirting the lake shore. It was along the foot of this escarpment that the river from the Dundas valley flowed (giving it its present form) to eastward of or near to Oswego, receiving many streams along its course.

6. The western portion of the Lake Erie basin, the south-western counties of Ontario, and the southern portion of the basin of Lake Huron formed one Preglacial plane, which is now covered with drift or water (or with both) to a depth varying from 50 to 100 feet, except in channels where the filling by drift is very great. A deep channel draining Lake Huron extended through this region, leaving the present lake near the Au Sable river, and entering the Erie basin, between Port Stanley and Vienna, at a known depth near its margin, of 200 feet, but at a probable depth in the center sufficiently great to drain Lake Huron.

7. The Preglacial valleys (now buried) of Ohio and Pennsylvania—for example, the Cuyahoga, Mahoning (reversed), and Allegheny (deflected)—formed tributaries to the great river flowing through the Erie basin and the Dundas valley.

8. The bays and inlets north of Lake Huron are true fiords in character, and are of aqueous origin.

9. The Great lakes owe their existence to sub-aërial and fluviatile agencies, being old valleys of erosion of great age, but with their outlets closed by drift. Glaciers did not excavate the lakes and had no important action in bringing about the present topography of the basins.

10. The old outlet of the Niagara river, by the valley of St. David's, was probably an interglacial channel.

THE IRON ORES OF SOUTHERN UTAH.—During the past summer, which I spent chiefly in Utah, I visited the deposit of crystalline iron ore of Iron county, in the southern part of the Territory. These ore beds have been long known and were to some extent utilized by the Mormons in their first advent, thirty years ago, but no satisfactory description of them has ever been published. As they constitute, perhaps, the most remarkable deposit of iron ore yet discovered on this continent, I have thought that some facts in regard to them might not be an unimportant addition to what is known of the economic resources of our country. The iron region referred to lies nearly three hundred miles directly south from Salt Lake city, and is situated in what is really the southern prolongation of the Wasatch mountains. The iron ores occur in the northern portion of a subordinate range, which attains its greatest height in Pine Valley mountain near Silver Reef. Thirty miles north of this point the ridge breaks down into a series of hills from one thousand to two thousand feet in height, which consist chiefly of gray fine-grained granite, with dykes and masses of trachyte and here and there outcrops of highly metamorphosed limestone. The ore beds form a series of protruding crests and masses set over an area about fifteen miles long in a north-east and south-west direction, and having a width of three to five miles. Within this belt the iron outcrops are very numerous and striking; perhaps one hundred distinct claims having already been located upon them, each one of which would make the fortune of a mining company if situated anywhere in the Mississippi valley or the Eastern States. The most impressive outcrops are in the vicinity of Iron springs, Oak springs and Iron city, of which localities the first and last mentioned are about twelve miles apart. Near Iron springs the *Big Blow-out*, as it is called, is a projecting mass of magnetic ore, which shows a length of perhaps a thousand feet by a width of five hundred, and rises in castellated crags one hundred feet or more above its base.

At Iron springs a still more striking exhibition is made by the Blair mine, which is a ragged crest of magnetite, black as jet,

formed by the upturned edge of the thickest of a series of sheets of ore, which rises like a ledge of bedded rock two or three hundred feet above the adjacent low lands. This outcrop is visible as a conspicuous black hill, at a distance of several miles. The connections between the ore bodies of this great iron belt are obscured by the *débris* from the easily decomposed trachyte and granite. It is evident, however, that for some miles the iron ore deposits are continuous or separated by very short intervals, as the outcrops occur within a stone's throw of each other, and the surface is everywhere strewed with blocks of rich magnetic ore, enough in themselves to supply all the furnaces of the country for years. It would seem that the iron forms a number of distinct and closely approximated belts, which are the outcrops of beds that stand nearly vertical, and go down into the earth like huge walls.

There is considerable diversity in the character of the ore, though it is about equally divided in quantity between hematite and magnetite. Some of the beds of both are exceedingly dense and compact, while others, though rich in iron, are soft and can be mined with the pick. Most of the ore is apparently very pure, containing a small amount of earthy matter and no foreign minerals. Some of the ledges, however, contain a large quantity of silica, the magnetite being mottled with white quartz; and one of the largest outcrops, though showing many millions of tons of ore apparently quite pure, is thickly set along certain zones, evidently strata of deposition, with crystals of apatite from a quarter to half an inch in diameter and two or three inches in length. At this location many of the fragments are highly magnetic, and lodestone as strong as any known can be obtained there in great abundance. A few rods from this great outcrop is another of equal dimensions, in which the magnetite is apparently quite free from all impurities, showing neither quartz nor apatite. Near by is another exposure, perhaps a continuation of the last, of which the mass is half magnetite and the other half fine-grained and dense hematite. Across a narrow valley from this group the hillside is covered with fallen fragments of a rich but soft and dark hematite, and at no great distance the soil is colored blood-red by the decomposition of a hematite so soft as to make no other show above the surface. Near this latter location I noticed a line of outcrop of a very jaspery hematite, in some places only a ferruginous jasper closely resembling some of the more silicious ores of the Marquette district.

As to the age of this remarkable series of iron ore deposits, I cannot speak with absolute certainty, though they are apparently Lower Silurian.

The granite of the hills which contain the iron is finer grained and less compact than that which forms the great granitic axis of the Wasatch, and I suspect is the metamorphic condition of the

quartzite beds which rest upon the Wasatch granite. Some of the iron ore beds in this granite are distinctly interstratified with it, and are certainly, like it, metamorphosed sediments. This is plainly shown at the Blair mine, where the principal crest of the hill is a distinct sheet of stratified, regularly bedded magnetite, from thirty to forty feet in thickness, dipping toward the north at an angle of about eighty degrees. Parallel with this principal layer are other sheets of magnetite separated by strata of granite and varying from a quarter of an inch to ten feet in thickness, as perfectly parallel and regular as any series of sedimentary beds ever seen.

On the whole, the Blair mine is the most interesting and instructive outcrop of iron known to me, and furnishes the most striking proof of the sedimentary origin of these wonderful ore beds. None of the other outcrops are so distinctly stratified, but the Big Blow-out at Iron city affords an equally conclusive argument against the eruptive theory; for while it appears to be a huge amorphous mass, like a hill of basalt, on examination it is found to be in large part composed of metamorphosed limonite; that is, magnetite, which has the botryoidal and concretionary aspect and radiated structure of limonite, and was plainly deposited from water.

With the exception of the great iron deposits of Southern Utah, the far West is but imperfectly supplied with this metal. I have found magnetite and specular ores in small quantities in several places in the mountains of Oregon and California, and in the Rocky Mountain belt, and similar ores have been met with by prospectors and explorers in some of the districts which I have not visited. We have no evidence, however, that any other great deposits of iron exist in or beyond the Rocky mountains. If it is true, which I do not believe, that there are anywhere iron ores that are truly eruptive in character, it is somewhat surprising that in the immense area where igneous rocks predominate in the far West, no masses of eruptive iron ore have been met with. We have reports of eruptive masses of magnetite at Nijni Tagilsk, in Russia, and of hematite on the island of Elba, but no observations have lately been made for the purpose of determining whether these are what they have been reported to be. The famous beds of magnetic and specular ore of Sweden have also been considered, up to a recent date, as eruptive, but Professor Otto Torrell, Director of the Geological Survey of Sweden, with whom I was associated in the Centennial Exhibition, assured me that all the deposits of iron which he had visited in Sweden were metamorphic and not eruptive, and that he had no faith in erupted ores of iron.—*J. S. Newberry, in School of Mines Quarterly, Nov., 1880.*

GEOLOGICAL NEWS.—A paper on the uniclinal structure of the Iberian peninsula, by J. Macpherson, is published in Spanish and English. A section of the rocks from the Mediter-

ranean to the Cantabrian coast is given.——Mr. Eugene Smith, State Geologist of Alabama, gives an account of the geology of Florida, in the April number of the *American Journal of Science and Arts.* He shows that the Vicksburg limestone occupies the center of the State, and that a small patch of earlier Miocene in the eastern center of the State, is the oldest formation within its limits. The everglades and coast regions are Postpliocene.——In the same journal Professor Marsh describes a new genus of Opisthocœlous saurians, which he calls *Cœlurus.* The vertebræ resemble those of *Camarasaurus*, but the walls are more attenuated, and the caudal centra are hollow. It is probable that *Amphicœlias fragillissimus* Cope, belongs to it. Professor Marsh proposes to regard the genus as the type of a new order, but gives no reasons for so doing.——The second annual report of the Bureau of Statistics and Geology of Indiana for 1880, under the direction of John Collett, is published. It includes reports on the Geological Survey of two counties, Monroe and Putnam; descriptions of new fossil Invertebrata, by R. P. Whitfield, and a synopsis of the recent Mollusca, by Frederick Stein, M.D.——Calvert and Neumayr publish in the Denkschriften of the Wiener Akademie, an article on the Tertiary formations of the Hellespont. They refer the latter to two divisions which are unconformable to each other, of which the inferior is upper Miocene. Fossil remains of *Vertebrata* and *Mollusca* are abundant and are described by the authors.——A deposit of carbonate of lead and silver carrying chloride of silver and embolite, forming the surface of a considerable hill, has recently been found in Southwestern New Mexico, by George Daly. It resembles the formation at the Silver King mine of Arizona, but is more extensive.——Mr. S. A. Miller, in the Journal of the Cincinnati Society of Natural History, continues his history of American geological work. His last article (April, 1881) covers the later writings on the Tertiary periods, but does not conclude this part of the subject. It covers forty-three pages, octavo, and includes much information of importance to geologists, in a condensed and conveniently accessible form. Lists of the fossil species are given.——In the same periodical, Professor A. G. Weatherby describes a number of new species of *Crustacea*, *Cephalopoda* and *Crinoidea* from the Silurian and Subcarboniferous rocks of Ohio and Kentucky. They consist of species of *Isochilina*, *Proetus*, *Cyrtoceras*, *Colpoceras*, *Trematodiscus*, *Reteocrinus* and *Heterocrinus.*——In the Proceedings of the Philadelphia Academy, Professor Heilprin discusses the fossils and age of the Lower Eocene formation of Clarke county, Alabama.

GEOGRAPHY AND TRAVELS.[1]

SIBERIA IN EUROPE.—Mr. Henry Seebohm, to whom we are already idebted for much valuable information concerning Siberia,

[1] Edited by ELLIS H. YARNALL, Philadelphia.